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SOIL SOLARIZATION FOR NEMATODE CONTROL

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Control of plant parasitic nematodes by heat is one of the oldest methods of managing nematode populations. Most nematodes are killed at temperatures above 48 C. Soil temperatures can be increased by steam, dry heat and soil solarization. While soil sterilization by steam assures complete nematode kill, it may also kill beneficial organisms and alter soil structure. Control of nematodes by dry heat usually involves removing the soil and heating it in an oven to the desired temperature. It requires excessive handling of the soil and may also destroy soil structure. Soil solarization is a simple process whereby heat from the sun is transferred to the soil. Solar heating involves a process of trapping solar energy in the soil by covering the soil surface with polyethylene tarps. There are several procedures that must be followed closely in order to be effective in increasing the soil temperature to control nematodes by solarization.

1. The soil must be well tilled and virtually free of clods, sticks and other debris that might tear the tarp. It is best to have the beds ready for planting before tarping.
2. The soil must be moist before the tarp is applied. This allows for a more efficient conduction of heat down through the soil profile resulting in a deeper and more effective kill of nematodes.
3. Solarization should be practiced in the hottest time of the year and when the incidence of sunlight is greatest. Normally 4 to 6 weeks is an adequate period of solarization; however, it is essential to check the soil temperature to determine if temperatures lethal to nematodes are obtained.
4. Selection of a plastic or polyethylene cover is probably the most important step in the operation. The cover must be clear and no more than 2 mills thick. It must be strong and durable so as to allow for stretching while being placed on the soil. Solarization tarps are now available. Black plastic is not adequate as it reflects sunlight, except in greenhouses.
5. Placement of the tarp is also very important. It must be stretched tight against the row or soil mass and should be in direct contact with the soil (Fig. 1.). Care must be taken to cover the edges of the tarp so as not to allow the wind to lift the tarp during the solarization period.
6. When removing the tarp it is important not to contaminate the solarized soil with soil that has not been treated. This is also true at planting and best results are obtained when beds are prepared for planting before solarization and immediately planted after removing the tarp.

Solarization also controls other soilborne organisms such as fungi, insects and weeds. Some of the earliest work in soil solarization was done on the hot, arid regions of Israel. Katan (2) has compiled an excellent review of soil solarization for control of soilborne pests which is primarily devoted to plant

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diseases. In the United States, workers in California (4) were successful in controlling nematodes to depths of 90 cm using solarization techniques. In Texas, (1) nematode populations were significantly suppressed with soil solarization to soil depths of 15 cm; however, this was sufficient to show significant yield increases in cowpea that followed the solarization treatment (Fig. 2). Soil solarization of Rockdale soils in Florida (3) resulted in a significant suppression of root-knot and reniform nematodes and nutgrass weed when compared to control plots. There are many other examples of successful nematode control using soil solarization techniques, and there are also cases where the technique did not give sufficient control. Temperature is the critical factor and this is determined by sunlight intensity and hours of uninterrupted sunlight per day.

With fewer nematicides available for nematode management and more emphasis on non-chemical control strategies, soil solarization will become more attractive to certain areas of agricultural production. Soil solarization is now feasible for use in gardens, seed and nursery beds, as well as in fields where shallow rooted high cash crops can be planted in the fall soon after the soil is solarized.

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Fig. 1. Soil solarization research plots showing beds prepared for planting with polyethylene covers fit tightly over the beds.

Fig. 2. Cowpea 45 days after planting in soil solarized for 8 weeks (right row) compared to non-solarized soil (left row).

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